



# **Floodwater Management Discharge Plan**

for

**Town of Nags Head  
Nags Head, NC**

**Revised  
August 23, 2017**

**NCDEQ Approval issued 8/28/2017**

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Project: Floodwater Management Discharge Plan  
Nags Head, NC 27959

Town of Nags Head

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## **Section One - Background**

The Town of Nags Head has experienced tremendous growth over the last few decades. With this growth, the watersheds have continued to undergo substantial development and redevelopment. The land-use changes that come with development have significant impacts on flood discharges and water quality. As the watersheds become more populated, the drainage facilities that were once adequate are now in excess of their capacity and diminishing their prior level of service. As development occurs, changes in the land cover also results, (i. e. increased impervious surface areas, less vegetation), adding to the volume of runoff produced and reducing the ability to treat runoff at the source.

These watersheds are also unique with a water table that is very shallow in many of the flood-prone areas. The shallow water table, along with the absence of or undersized drainage infrastructure, aggravate flooding problems, and prove to be the limiting factors for many conventional stormwater management options.

## **Section Two - Topography**

The physical landforms of the area within the Town of Nags Head have played a major role in the development of both natural and manmade drainage. Primary characteristics consist of a maritime forest zone to the west transitioning to smaller dunes and troughs within the shrub zone to the primary beach and foredune section to the east. A transect of the existing topographic elevations in this region range between an elevation of 15' and 20' mean sea level (msl) on the frontal or foredune sections and the Jockey's Ridge major dune complex on the west side which reaches heights in excess of 90' msl. From this transect, we can begin to understand the main reason why these watersheds are subjected to flooding. Located within the trough between the maritime forest and the foredune section, a "bowl like" formation is created by this topography. As it rains, the water infiltrates into the dunes and troughs and collects at the lowest elevations. A mounded groundwater condition is created at the low points, and typically contained just below the ground surface within the trough system. Due to this, the subsurface water table elevations are typically very shallow, ranging between 0 to 3 feet below the existing ground surface under normal conditions and can mound above the ground surface during wet periods.

## **Section Three - Existing Drainage Infrastructure**

The existing stormwater drainage system for the Town relies heavily on five (5) ocean outfalls maintained by the North Carolina Department of Transportation (NCDOT). Four of the outfalls are located within Town limits and the fifth is located immediately south of the Town boundary. The outfalls were originally constructed to provide a mechanism for draining ocean overwash events when the storm surge from the ocean overtopped the dunes. In addition (12) outfalls exist along the western portion of the Town draining either to the Roanoke Sound or to the marsh areas west of South Nags Head.

Although the Town has approximately 55 miles of drainage ditches, pipes, swales and structures, they are limited by their capacity to manage stormwater for lower-lying properties that exist within the Town limits.

## Section Four - Basis for Request

The Town of Nags Head is located on a barrier island bordered by the Atlantic Ocean and Roanoke Sound making it extremely vulnerable to flooding and ocean overwash. The greatest flood threats for Nags Head properties come from hurricanes, nor'easters, extended rainfall patterns and seasonal high tides. Previous storms have caused ocean over wash, flooding from the sound, or localized flooding in low-lying areas. The following is a list of recent storms where varying levels of overwash/rainfall flooding has been experienced;

- 1962 Ash Wednesday Storm ocean overwash event
- 1991 Halloween Storm ocean overwash event
- 1992 July/August extended rainfall pattern
- 1993 March storm ocean overwash
- 2000 July/August extended rainfall pattern
- 2003 Hurricane Isabel ocean overwash event
- 2004 July August extended rainfall pattern
- 2006 Tropical Storm Ernesto
- 2009 Veterans Day Storm ocean overwash event
- 2011 Hurricane Irene
- 2012 July/August extended rainfall pattern
- 2012 Hurricane Sandy
- 2014 Hurricane Arthur
- 2015 Tropical Storm Joaquin
- 2016 Tropical Storm Hermine
- 2016 Hurricane Matthew all throughout Town
- 2017 July to current extended rainfall pattern

The most recent storm event, Hurricane Matthew, although only a Category One Hurricane, delivered record amounts of rainfall throughout Nags Head. Rainfall measurements recorded range between 11.7 in. to 13.7 in. across the Town of Nags Head, most of which occurred during a 6 hour period between 10 pm on October 8, 2016 and 4 am October 9, 2016. Peak flood water levels measured in the low-lying areas were documented as much as 3.5' deep. Significant portions of NC 12 (S. Virginia Dare Trail), and to a smaller extent US Hwy 158 (S. Croatan Hwy.), were flooded creating conditions where public health and safety were endangered.

In response to the emergency conditions the Town submitted a request to NCDEQ, Division of Water Resources, with a proposal for the implementation of an emergency pumping operation to alleviate the widespread flooding. Supporting documentation included a map exhibit depicting the flooded extents and photographic documentation with supporting floodwater depth measurements. While this information was being gathered, pumps were delivered to the proposed discharge site and sat idle for approximately 18 hours before an approval could be issued.

This delay was compounded by vehicular traffic along these routes creating floodwater "wakes" worsening the situation for the waterlogged lower-lying businesses. The "Gallery Row" watershed experienced the largest adverse impacts due to size and intensity of development of the watershed.

Flooding impacts both individuals and communities and have social, economic and environmental consequences. Immediate impacts can include loss of human life, damage to property, restrict or limit access to emergency services, damage to infrastructure and deterioration of local health conditions. Prolonged effects of standing water from flooding can create environmental conditions for the growth of bacteria, viruses, mold and an increased risk of waterborne diseases.

From the recent storm events, flood waters have taken several weeks to recede in the most severe conditions, with pumping being the only viable alternative to alleviate flooding.

This request is being provided to support an expedited approval process for the Town of Nags Head to conduct emergency floodwater pumping and discharge operations.

### **Section Five – Management Plan Design Concept**

The proposed Emergency Floodwater Management Discharge Plan has been developed to permit temporary pump stations for discharge of floodwaters to the Atlantic Ocean and/or the Roanoke Sound, or one of its tributaries, on an emergency basis in accordance with North Carolina Department of Environmental Quality, (NCDEQ), Division of Water Resources (DWR), Water Quality Regional Operations Section, (WQROS). The following outlines a general procedure for the implementation of the emergency pumping program;

Each of the four northern ocean outfalls is located strategically at a low point within the surrounding topography to be able to drain the tributary landscape. Project pumping operations could commence immediately after NCDENR-DWR/WQROS approval and the pump and discharge appurtenances in place. The initial focus of the dewatering operations will be to reduce the floodwater depth from the major roadways in Town.

In general, the emergency pumping locations for the dewatering of major roadways will be positioned along NC 12 adjacent to one of the inlets at each of the ocean outfalls, (see Appendix A-E). Any equipment or appurtenances located within the state maintained right-of-way would be coordinated directly with the North Carolina Department of Transportation County Maintenance Engineer, (see Appendix F). Trailer mounted dewatering pumps will discharge stormwater via above ground discharge hose which will be placed along Town right-of-ways or existing drainage easements, extending out to the beach face and placed a minimum of 25' from the toe of frontal dune, as conditions permit. A method of velocity dissipation will be employed at the point of discharge to reduce erosion and scouring, (see Appendix H for installation). It is anticipated that the pipe discharge and velocity dissipation measures shall require relocation a minimum of every 6-8 hours or whenever conditions warrant relocation. Supplemental measures may be required to supplement standard discharge velocity dissipation measures. The source of the water expected to be pumped is rainfall runoff and/or surface water overwash.

Town streets will be assessed on a case by case basis for dewatering operations. The order of priority will be major streets, collector streets, local access streets, subcollector streets, and environmental streets as defined in the Town Code of Ordinances, (see Appendix G). Standing floodwaters on roadways will be discharged to the nearest accessible point of the Towns drainage system via an existing storm

drain structure, i.e. drop inlet, catch basin or junction box, as required, to reduce localized erosion at the point of discharge and minimize downstream sediment transport.

## **Section Six - Emergency Floodwater Pump Water Levels**

Floodwater depths vary within the Town due to a multitude of factors. Several contributing factors include; finished surface elevations in relation to mean sea level, surrounding topography, relationship to existing drainage system or absence thereof and intensity of development pattern. Due to this variability, it is extremely difficult to establish a defined vertical control elevation for floodwater dewatering operations. In lieu of a fixed vertical elevation reference, a simplified approach is being requested to be considered with operational measurements taken from the finished roadway surface.

According to FEMA documentation, six inches of water will reach the bottom of most passenger cars causing loss of control and possible stalling. The Town will initiate pumping operations in accordance with these guidelines. The measurement will be taken from the center of the travel lane which will serve as an average floodwater depth.

In response to extreme storm events, such as hurricanes, tropical storms and nor'easters, it is vital to restore to pre-storm conditions as rapidly as possible. Recovery efforts can only commence when roadways are clear of floodwaters permitting access for emergency services and debris removal operations.

Roadway elevations in the Town of Nags Head vary in relation to surrounding finish surface grades for residential and commercial development. Older construction is generally located below existing roadway surface elevations with more recently completed structures located above existing roadway surfaces. Existing drainage infrastructure along major roadways and collector streets can be discontinuous, inconsistent or absent altogether. Due to this, standing water may persist for extended periods of time along and adjacent to these heavily traveled corridors.

Lower-lying properties are further aggravated from "wakes" created by vehicular traffic. To balance this disparity in adjoining surface elevations and traffic induced flood water "wake" conditions, dewatering operations will cease when an approximate 2 inch floodwater depth is measured on the pavement surface, measured from the center of the travel lane, or when emergency conditions no longer remain as determined by the program manager. The intent of this program is to operate in response to a single weather event or storm system which creates emergency conditions where public health and safety are endangered. It is anticipated that emergency conditions will likely be met in severe cases of moderate flooding and all instances of major flooding, (see definitions Appendix K for flooding descriptions).

## **Section Seven - Pump Operation Protocol**

Project oversight will be under the responsible charge of the Towns Public Works Director or assigned designee. The following outlines the general emergency floodwater protocol for management of the program;

Position:	Director of Public Works (Essential) or Assigned Designee(s)
<b>Duties before a storm event (preparedness):</b>	<p><b>NOTE:</b> Public Works personnel also utilize an emergency plan entitled: <i>"Public Works Standard Operating Procedures for Hurricane Preparedness"</i>.</p> <ul style="list-style-type: none"> <li>• Establish contact with the Towns designated Debris Removal Contractor to coordinate the potential for pre-staging of portable emergency pumps.</li> <li>• Obtain updated estimate from Towns designated Debris Removal Contractor for pre-staging of pumps.</li> <li>• Consult w/Town Manager and Board on pre-staging of pumps.</li> <li>• Monitor weather reports on storm.</li> <li>• As approved, Issue Notice to Proceed to contractor for emergency pump mobilization.</li> <li>• Pre-stage pumps at Town of Nags Head Public Works Complex in advance of event. Coordinate with contractor.</li> <li>• Provide contractor with the <i>Town of Nags Head Emergency Floodwater Management Plan</i> if contractor is to supply personnel to conduct pumping operations.</li> <li>• Review pump locations, system setup, pumping protocol and pump activity documentation with contractor in advance of operations.</li> </ul>
<b>Duties during a storm event (recovery):</b>	<ul style="list-style-type: none"> <li>• Monitor event and take action to save property depending on severity of storm.</li> <li>• Monitor storm for reports of damage and areas impacted by floodwaters.</li> </ul>
<b>Duties Immediately after a storm event (recovery):</b>	<ul style="list-style-type: none"> <li>• Assess damage to Town property and right-of-ways and extent of flooding, (via ocean overwash or rainfall).</li> <li>• Within 24 hours post storm event or as conditions permit, conduct roadway assessments and measure floodwater depth in accordance with Section Six Floodwater Emergency Pump Water Levels.</li> <li>• If water levels exceed 6" in depth on the roadway surface, as defined in Section Six, contact NCDEQ, Division of Water Resources Emergency Contact, (see Appendix F), to obtain Emergency Floodwater Pumping authorization. Justification and supporting photographic documentation shall be provided. Authorization shall be documented, (e-mail form is acceptable)</li> <li>• Coordinate with NCDOT County Maintenance Engineer or other assigned emergency contact number for right-of-way encroachment authorization to permit emergency pump operations, (see Appendix F). Request shall include NCDOT authorization to conduct temporary road closures in the</li> </ul>

	<p>Authorization shall be documented, (e-mail form is acceptable).</p> <ul style="list-style-type: none"> <li>• Coordinate temporary road closures with Town of Nags Head Police Dept. Temporary road barricades shall be installed.</li> </ul>
<b>Duties to establish Emergency Pump Operations (Recovery):</b>	<ul style="list-style-type: none"> <li>• Field review with contractor to location of pump, suction line, discharge line layout and end of pipe erosion control measures to ensure compliance with NCDEQ-DWR approved plans.</li> <li>• As applicable, submit emergency pumping operations plan deviations to NCDEQ-DWR for permit authorization. Documentation shall be in written form.</li> <li>• Determine adequacy of establishing discharge point along shoreline based upon post-storm tide levels.</li> <li>• Non-Oceanfront discharge applications- locate nearest drop inlet, catch basin or junction box for direct discharge into to minimize downstream erosion and scouring.</li> <li>• Safety fencing shall be installed around the perimeter of the discharge point to prevent the general public from interfering with discharge operations.</li> <li>• Locate discharge hosing as close to shoreline as practicable and a minimum of 25' from toe of frontal dune.</li> <li>• Issue notice to proceed to contractor once it has been determined pump setup is suitable and in accordance with approved plan.</li> <li>• Install approved individual signage, (1) each, proximate to the oceanfront discharge locations; 200' upcoast of point discharge, 200' downcoast of point discharge and one within 50' of point discharge location. For non-oceanfront locations, install (1) approved individual sign within 25' of pump discharge location. (See Appendix J for approved sign format).</li> <li>• Implement non-discharge alternatives to the extent feasible.</li> <li>• Take photos of system setup.</li> </ul>
<b>Duties during Emergency Pump Operations (Recovery):</b>	<ul style="list-style-type: none"> <li>• Maintain Pump Operation Activity Log, (see Appendix I), noting pump run times, approximate pump flow (gpm), erosion control measure adjustments, etc..</li> <li>• Monitor pump operations at all active pump locations.</li> <li>• If the duration for pumping operations at any one location is greater than a 24 hour period, a water quality testing regime shall be employed.</li> <li>• Monitor discharge point and make necessary adjustments in relation to tidal changes, scouring and erosion. It is anticipated that the pipe discharge and velocity dissipation measures shall require relocation a minimum of every 6-8 hours or whenever conditions warrant relocation. Supplemental measures may be required to supplement</li> </ul>

	<p>Supplemental measures may be required to supplement standard discharge velocity dissipation measures.</p> <ul style="list-style-type: none"> <li>• Review discharge line and impacts to primary and fontal dunes.</li> <li>• Coordinate supplemental fuel supplies shall be provided to permit continuous operation.</li> <li>• Monitor all suction and discharge hoses during operation. Make repairs as necessary.</li> <li>• Monitor floodwater depth levels at suction line intake to determine when the emergency pump off criteria has been met in accordance with Section Six. Issue notice to cease operations and document time and location when emergency conditions no longer exist.</li> <li>• Compile daily activity data and forward operational summary to NCDEQ-DWR via email.</li> <li>• Coordinate with the pump contractor on required on-site pump maintenance and fuel needs.</li> <li>• Pumps shall be operated and maintained in accordance with manufacturers recommended guidelines.</li> <li>• Pump suppliers on-site technician shall address any mechanical or operation issues.</li> <li>• Take photos of system in operation.</li> <li>• At a minimum, check discharge points at least every (3) hours.</li> </ul>
<b>Duties Post Emergency Pump Operations (Recovery)</b>	<ul style="list-style-type: none"> <li>• Monitor pump removal operations. Minimize impacts to discharge line route and point of discharge.</li> <li>• Inspect all pumps and hoses for damage</li> <li>• Restore any disturbed areas back to original conditions.</li> <li>• Take post-pump operations condition photos.</li> <li>• Compile all Pump Activity Logs, photographs, inspection reports, etc. and prepare a comprehensive summary and forward onto NCDEQ-DWR as requested and retain on file.</li> <li>• Remove advisory signs after receiving authorization from Environmental Planner.</li> <li>• Update Floodwater Management Discharge Plans a minimum of every 2 years and coordinate with NCDEQ-DWR-WQROS-Regional Office</li> </ul>

## Section Eight - Water Quality Monitoring Regime

The Town of Nags Head conducts surface water quality sampling as part of the Septic Health Initiative Program. Surface water quality monitoring is currently collected monthly by an environmental contractor at pre-designated locations throughout Town and tested via a third-party state certified laboratory.

Water Quality testing will be conducted for the parameters utilized by the N.C. Recreational Water Quality Program (RWQ). RWQ test for enterococcus bacteria, an indicator organism found in the intestines of warm-blooded animal. While it will not cause an illness itself, its presence is correlated with that of organisms than can cause illness. People swimming or playing in waters with bacteria levels higher than the action level have an increased risk of developing gastrointestinal illness or skin infections.

Bacteria limits that exceed the state and federal action levels of 104 enterococci per 100 milliliters for Tier 1 high usage sites require an advisory posting. Swimming areas are classified based on recreational use and are referred to as tiers.

Daily grab samples will be collected in the surf zone at each of the proposed surface water discharge locations and submitted to a state certified testing laboratory for results. Surface water sampling will be conducted until at which time the enterococcus bacteria levels decrease below the standards noted above.

<b>Position:</b>	<b>Environmental Planner or Assigned Designee(s)</b>
<b>Duties before a storm event (preparedness):</b>	<ul style="list-style-type: none"> <li>• Coordinate with third-party testing facility for updated pricing and confirmation of expedited testing results .</li> <li>• Coordinate with Town’s designated water quality monitoring contractor on availability post-storm event to conduct testing in accordance with the guidelines as noted in Section Eight, OR</li> <li>• Check supply of sample containers to conduct in-house water quality sampling, as required.</li> <li>• Review testing protocol and procedures as outlined in Section Eight.</li> </ul>
<b>Duties during Emergency Pump Operations (Recovery):</b>	<ul style="list-style-type: none"> <li>• Coordinate with Water Quality Monitoring Contractor on scheduling and grab sample locations.</li> <li>• Coordinate with Department of Public Works and monitor pumping schedule to conduct water quality sampling.</li> <li>• Conduct daily water quality sampling.</li> <li>• Once grab samples have been obtained, forward to third-party testing company, (via contractor or by Town).</li> <li>• Will serve as the primary contact with third-party testing company and compile all testing results. Forward results to Public Works Director.</li> </ul>
<b>Duties Post Emergency Pump Operations (Recovery)</b>	<ul style="list-style-type: none"> <li>• Continue daily sampling events until testing results are within the acceptable range of NC Recreational Water Quality Limits.</li> <li>• Coordinate with the Department of Public Works on advisory sign removal.</li> <li>• Retain all results and records and make available to the Public Works Director.</li> </ul>

## **Section Nine – Program Management and Organization**

Initially, the Town of Nags Head will utilize its Debris Removal Contractor for pump rentals and on-site maintenance. Pumps necessary for emergency pumping periods are anticipated to consist of trailer mounted, dry prime gasoline or diesel, suction lift pumps. The number of pumps and pump sizes will vary but it is expected that pump sizes may be between 6" and 8" discharges and supplemented by smaller diameter dewatering depending on floodwater depths and locations. All pumps to be provided with the operations shall be capable of handling water, slurries and liquids with solids.

Piping and fittings should be standardized quick disconnect (QD) type for all suction and discharge lines. Discharge lines can be either ridged or lay-flat type pipe depending on location and installation methods. Suction lines and fittings must be rated for their use. Other discharge fittings may be necessary based upon pump and hose orientation.

The discharge line shall be secured and energy dissipation shall be provided at each oceanfront discharge location which will minimize erosion and scouring along the beachface. The outlined method of restraint and energy dissipation is described in Appendix H, *Pipe Discharge Energy Dissipater Detail*, and may be modified depending upon site conditions, tidal levels and other conditions that may be present during the pumping period.

The Contractor shall be responsible for pre-staging of all equipment and appurtenances at the Town of Nags Head Public Works Complex in addition to providing transport of said material and equipment to the designated temporary pump locations. The Contractor will provide the necessary equipment and personnel to maintain the pumps during the course of operation in addition to providing transport between multiple pump locations, as required. The Contractor shall be responsible for all means, materials and methods necessary to establish and cease pumping operations and for the removal of all pumping apparatus.

It should be noted that additional equipment and supplies may be necessary to conduct and maintain pump and discharge operations in addition to restoration of any disturbed areas that may occur during the course pumping activities.

The management of the Emergency Floodwater Management Plan will be overseen by the Town of Nags Head Public Works Director or assigned designee. His/her duties and responsibilities are described in Section Seven in addition to any supplemental services that may be necessary to carry out the program. The water quality monitoring component of this program will be under the responsible charge of the Town of Nags Head's Environmental Planner or appointed designee.

## **Section Ten – Program Plan Modifications**

The intent of this plan is to provide general guidance to establish emergency floodwater dewatering operations in accordance with NCDEQ-DWR policies and procedures. Post-storm event field conditions or other extenuating circumstances may warrant changes to the information noted within the plan documents. Any and all modifications shall be documented and coordinated with NCDEQ-DWR in advance of dewatering operations. Floodwater Management Discharge Plans shall be updated a minimum of every 2 years and submitted to the NCDEQ-DWR-WQROS-Regional Office for approval.





# Town of Nags Head Temporary Pump Station Map



**Gallery Row Temporary Pump Location**

Atlantic Ocean

**Curlew Temporary Pump Location**

## Legend

- Centerlines
- Parcels

**Conch Temporary Pump Location**

**Soundside Temporary Pump Location**

0.0 0.1 0.2 0.3 0.4  
Miles

## APPENDIX B – GALLERY ROW TEMPORARY PUMP STATION

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# Town of Nags Head Temporary Pump Station Map Gallery Row

Atlantic Ocean

Temp. Pump Station

End of Pipe Energy  
Dissipater



VIRGINIA DARE

MEMORIAL

ABALONE

## Legend

- Centerlines
- Parcels

0.000 0.0075 0.015 0.0225 0.03  
Miles

## APPENDIX C – CURLEW TEMPORARY PUMP STATION

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# Town of Nags Head Temporary Pump Station Map Curlew

Atlantic Ocean



Temp. Pump Station

CURLEW

End of Pipe Energy  
Dissipater

VIRGINIA DARE

## Legend

- Centerlines
- Parcels

0.000 0.0075 0.015 0.0225 0.03  
Miles

## APPENDIX D – CONCH TEMPORARY PUMP STATION

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# Town of Nags Head Temporary Pump Station Map Conch

Atlantic Ocean



Temp. Pump Station

End of Pipe Energy  
Dissipater

CONCH

VIRGINIA LANE

CONCH

CROATAN

## Legend

- Centerlines
- Parcels

0.000 0.0075 0.015 0.0225 0.03  
Miles

## APPENDIX E – SOUNDSIDE TEMPORARY PUMP STATION

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# Town of Nags Head Temporary Pump Station Map Soundside

Atlantic Ocean



Temp. Pump Station

End of Pipe Energy  
Dissipater

VIRGINIA DARE

## Legend

- Centerlines
- Parcels

0.000 0.0075 0.015 0.0225 0.03  
Miles



## APPENDIX G – TOWN OF NAGS HEAD STREET PRORITY LIST

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## Chapter 36 - STREETS, SIDEWALKS AND OTHER PUBLIC PLACES<sup>[1]</sup>

### Footnotes:

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**Cross reference**— Any ordinance dedicating, naming, establishing, locating, relocating, opening, widening, paving, etc., any street or public way in the town saved from repeal, § 1-9(6); any ordinance providing for local improvements and assessing taxes for such improvements saved from repeal, § 1-9(9); any ordinance levying or imposing taxes not included in this Code saved from repeal, § 1-9(14); any ordinance establishing or prescribing street grades in the town saved from repeal, § 1-9(15); outdoor performances and events, § 4-41 et seq.; parades, picket lines and group demonstrations, § 4-161 et seq.; beaches and waterways, ch. 8; buildings and building regulations, ch. 10; moving of buildings and structures, § 10-121 et seq.; peddlers and itinerant merchants, § 12-101 et seq.; yard sales, § 12-221 et seq.; environment, ch. 16; excavations, ch. 18; floods, ch. 22; mobile homes, mobile home parks and trailers, ch. 24; obstructions in street or highway right-of-way, § 26-5; maintenance of sidewalks, rights-of-way, other public property, § 30-17; subdivisions, ch. 38; telecommunications, ch. 40; cable systems construction standards, § 40-161 et seq.; traffic and motor vehicles, ch. 42; riding horses on streets, § 42-7; utilities, ch. 44; vehicles for hire, ch. 46; zoning, ch. 48; off-street parking and loading requirements, § 48-161 et seq.; signs and outdoor advertising structures, § 48-281 et seq.; outdoor lighting, § 48-321 et seq.

**State Law reference**— General municipal authority relative to streets and sidewalks, G.S. 160A-296 et seq.

### ARTICLE I. - IN GENERAL

#### Sec. 36-1. - Definitions.

The following words, terms and phrases, when used in this chapter, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

*Collector street* means a street which serves or is designed to serve as a traffic-way for a neighborhood or as a feeder to a major street from local access streets. Collector streets collect traffic from 100 to 400 dwelling units.

*Environmental street* means a local street intended to serve primarily as a direct access to residentially zoned properties in environmentally sensitive areas with a projected low traffic count, on which through traffic is discouraged and which is designed to serve no more than 50 dwelling units. An environmental street shall be a cul-de-sac, a loop street less than 2,000 feet in length or a street that does not connect with more than one major street, unless otherwise required by this article. An environmental street is only allowed within 100 feet of estuarine waters, within a maritime forest, a residential subdivision street located wholly or partially within the CAMA Fresh Pond area of environmental concern (AEC). A street location within an environmentally sensitive area may be selected only if no other feasible location exists within the proposed development.

*Local access street* means a street intended to serve primarily as a direct access to abutting properties, and on which through traffic is discouraged. A local access street is a cul-de-sac, a loop street less than 2,500 feet in length, or a street less than one mile in length which does not connect major streets. A local access street does not collect traffic from more than 100 dwelling units.

*Major street* means a street which serves or is designed to serve heavy flows of traffic and which is used primarily as a route for traffic between communities or other heavy traffic-generating areas. Specifically, the term includes any state-maintained highway.

*Subcollector street* means existing streets for which the right-of-way is less than 60 feet.

(Code 1990, § 17-1; Ord. No. 08-02-010, § I, 2-6-2008)

**Cross reference**— Definitions generally, § 1-2.

Sec. 36-2. - Applicability of chapter provisions.

This chapter shall apply to the creation, design, construction and paving of all streets in the town; except, that the provisions of chapter 38 of this Code shall apply within all subdivisions proposed for development under such chapter and the provisions of the zoning ordinance shall apply to developments, construction and uses for which a permit is required under such chapter.

(Code 1990, § 17-2)

Sec. 36-3. - Purpose of chapter.

The residential street standards set forth in this chapter are a policy of the town. The purpose of this chapter is to provide additional detail for residential streets and promulgate residential street standards which will serve the longterm interests of the town. All streets will be built to these standards.

(Code 1990, § 17-3)

Sec. 36-4. - Design standards.

(a) *Street geometrics*. Geometric design for local access streets and collector streets shall conform to the following criteria:

Geometric feature	Local access street	Collector street	Subcollector street <sup>(4)</sup>	Environmental street
Right-of-way width	60 feet	70 feet	less than 60 feet	minimum of 40 feet (only 35 feet shall be cleared in a maritime forest)
Pavement width	24 feet <sup>(1)</sup>	24 feet <sup>(1)</sup>	20 feet <sup>(2)</sup>	20 feet <sup>(2)</sup>
Width of aggregate shoulder	4 feet	6 feet	2 feet	2 feet
Maximum cut and fill slopes	6:1	6:1	4:1	3:1
Design speed	30 mph	35 mph	25 mph	25 mph
Minimum stopping sight distance	200 feet	250 feet	200 feet	200 feet

Minimum centerline radius	250 feet	350 feet	250 feet	250 feet
Superelevation of curves	not allowed	not allowed	not allowed	not allowed
Maximum grade	6 percent	6 percent	6 percent	12 percent
Minimum cul-de-sac radius				
Right-of-way	50 feet	—	45 feet	50 feet
Edge of pavement	40 feet	—	40 feet	40 feet
K = Rate of vertical curvature for minimum stopping sight distance on vertical curve	28 <sup>(3)</sup>	45 <sup>(3)</sup>	18 feet	18 feet

*Notes:*

<sup>(1)</sup> On curves with a centerline radius less than 750 feet the pavement shall be widened to 26 feet from point of curvature to point of tangency by adding two feet to the inside edge. Transition from 24 feet to 26 feet shall take place in 100 feet or more outside the curve.

<sup>(2)</sup> On curves with a centerline radius less than 750 feet the pavement shall be widened to 22 feet from point of curvature to point of tangency by adding two feet to the inside edge. Transition from 20 feet to 22 feet shall take place in 100 feet or more outside the curve.

<sup>(3)</sup> The formula for determination of length of vertical curve required to provide minimum stopping sight distance shall be as follows:

$$L = KA,$$

L = Length of vertical curve in feet,

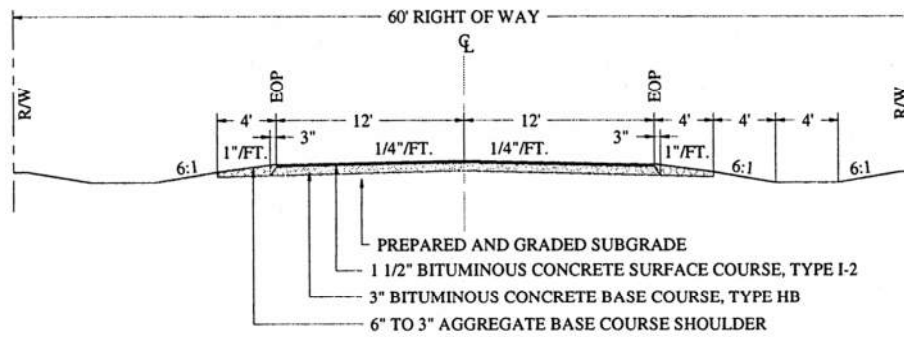
K = Rate of vertical curvature in feet per percent of A,

A = Algebraic difference in grades in percent.

<sup>(4)</sup> Subcollector streets are not permitted in newly created subdivisions. Subcollector streets and standards are applicable only to streets within subdivisions created prior to December 6, 1971, adoption of the subdivision chapter.

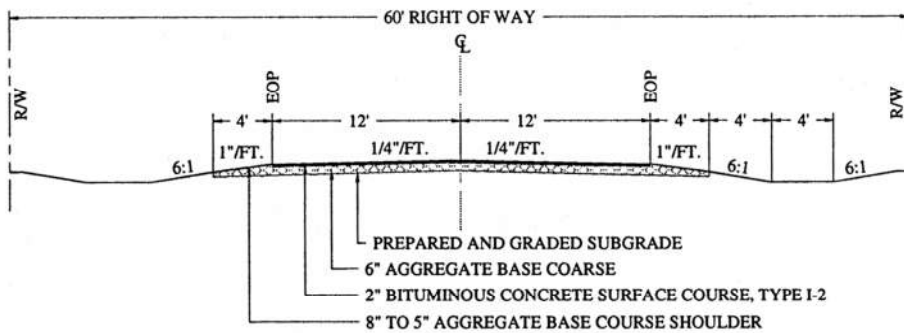
(1) The following typical cross sections shall apply to local access streets:

## LOCAL ACCESS STREETS



NOTE:  
0.20 TO 0.50 GAL/SYD TACK COAT BETWEEN ALL BITUMINOUS COURSES

## TYPICAL FULL WIDTH FINISHED SECTION (FULL DEPTH ASPHALT)

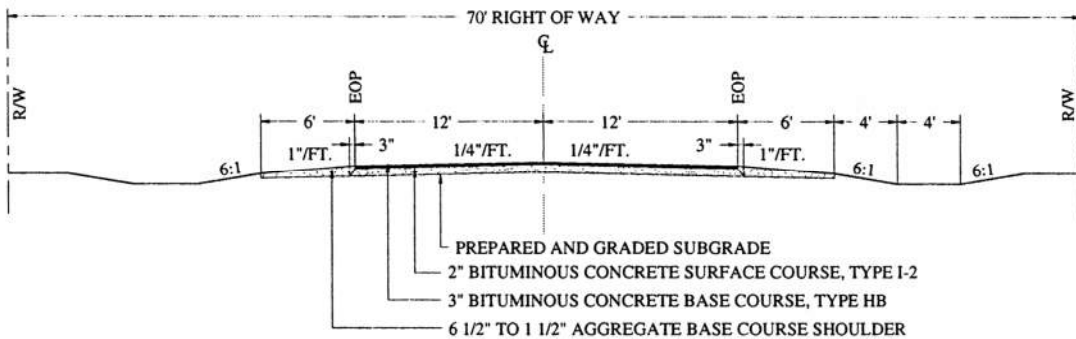


NOTE:  
0.18 TO 0.45 GAL/SYD PRIME COAT ON AGGREGATE BASE COARSE

## TYPICAL FULL WIDTH FINISHED SECTION (BITUMINOUS SURFACE ON AGGREGATE BASE COURSE)

(2) The following typical cross sections shall apply to collector streets:

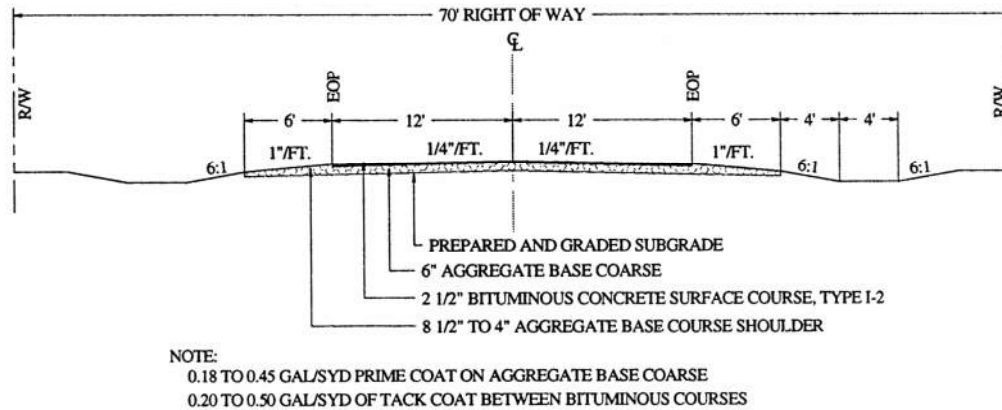
## COLLECTOR STREETS



NOTE:  
0.20 TO 0.50 GAL/SYD OF TACK COAT BETWEEN ALL BITUMINOUS COURSES

## TYPICAL FULL WIDTH FINISHED SECTION (FULL DEPTH ASPHALT)

### Typical Full Width Finished Section



**TYPICAL FULL WIDTH FINISHED SECTION**  
(BITUMINOUS SURFACE ON AGGREGATE BASE COARSE)

### Typical Full Width Finished Section

- (3) The following typical cross sections shall apply to subcollector and environmental streets with the exception that environmental streets shall have maximum cut and fill slopes of three to one rather than four to one as shown in the cross sections.

40'-50' RIGHT OF WAY

R/W

EOP

2'

10'6"

10'6"

EOP

2'

4'

R/W

1" / FT.

3"

1/4" / FT.

1/4" / FT.

3"

4:1

4:1

4:1

PREPARED AND GRADED SUBGRADE

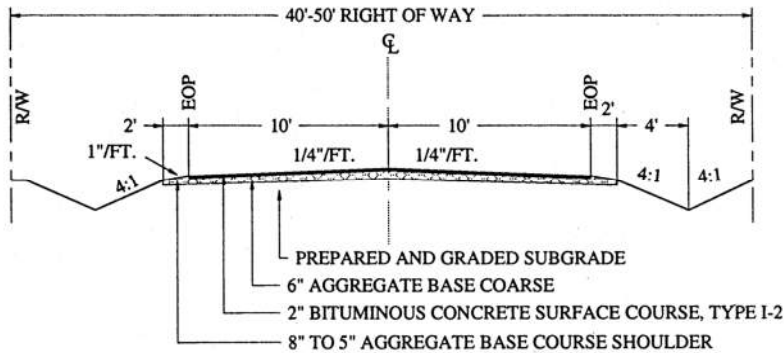
1 1/2" BITUMINOUS CONCRETE SURFACE COURSE, TYPE I-2

3" BITUMINOUS CONCRETE BASE COURSE, TYPE HB

6" TO 3" AGGREGATE BASE COURSE SHOULDER

NOTE:  
0.20 TO 0.50 GAL/SYD OF TACK COAT BETWEEN ALL BITUMINOUS COARSE  
\* 12-FOOT TOTAL WIDTH FOR ONE-WAY TRAFFIC IN FRESH POND AEC

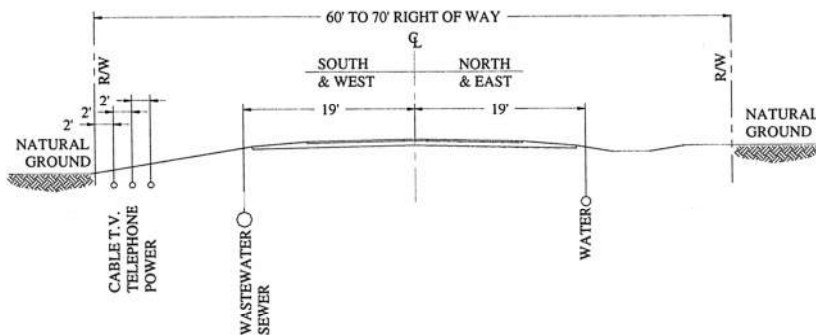
**TYPICAL FULL WIDTH FINISHED SECTION**  
(FULL DEPTH ASPHALT)



NOTE:  
0.18 TO 0.45 GAL/SYD PRIME COAT ON AGGREGATE BASE COARSE

**TYPICAL FULL WIDTH FINISHED SECTION**  
(BITUMINOUS SURFACE ON AGGREGATE BASE COURSE)

- (b) *Utility locations.* Recommended location of utilities with respect to the street is found on the following diagram:



### LOCATION OF UTILITIES

## **Typical Street Type Examples and Priority List**

### **Major Streets**

S. Croatan Hwy (US Hwy 158)  
S. Virginia Dare Tral (NC 12)

### **Collector Streets**

S. Memorial Ave.  
S. Wrightsville Ave.

### **Local Access Street**

W. Oak Knoll Dr.  
Linda Lane

### **Subcollector Street**

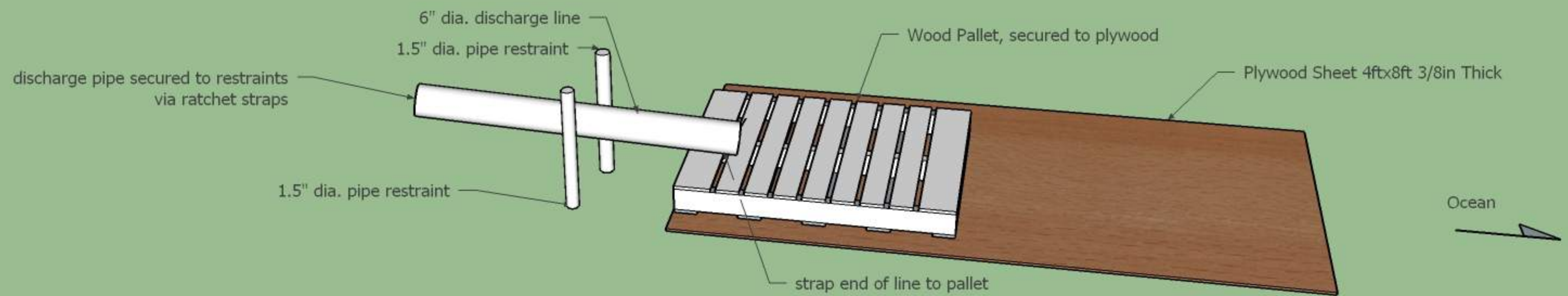
Bonnett St.  
E. Gray Eagle St.

### **Environmental Street**

W. Carolinian Circle  
Old Nags Head Woods Rd.

## APPENDIX H – PIPE DISCHARGE ENERGY DISSIPATER DETAIL

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**Discharge Pipe Energy Dissipater Detail**

## APPENDIX I – EMERGENCY PUMP OPERATION ACTIVITY LOG

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Post Office Box 99  
Nags Head, North Carolina 27959  
Telephone 252-441-1122  
Fax 252-441-3350  
[www.nagsheadnc.gov](http://www.nagsheadnc.gov)



Administration  
Maintenance Garage  
Public Facilities Maintenance  
Sanitation  
Water Distribution  
Water Operations

Pump Location \_\_\_\_\_  
Pump Start Date \_\_\_\_\_  
Operator \_\_\_\_\_

## Floodwater Management Discharge Plan Pump Activity Log

[illegible]

## APPENDIX J – EMERGENCY PUMP SIGNS

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# **WARNING!**



**STORMWATER DISCHARGE  
AREA SWIMMING WITHIN  
200 FT OF THIS SIGN MAY  
INCREASE THE RISK OF  
WATERBORNE ILLNESS**

**CONTACT TOWN OF NAGS  
HEAD PUBLIC WORKS  
DEPARTMENT AT  
252.441.1122  
FOR MORE INFORMATION**



## **Flooding Definitions**

### **Minor Flooding** *is defined as:*

Flooding occurs within 6 hours of heavy rain. Storm drains and retention ponds become near-full and begin to overflow in a few places. Drainage canals, ditches and swales may become swollen and overflow in a few places. In flatter terrain, ponding of water occurs around developed areas, especially in historically vulnerable locations. Minor flooding impacts roadways and low-lying structures with minimal or no property damage, but potentially some public threat. Examples of conditions that would be considered minor flooding include:

- water over ditch banks and in yards
- personal property in low lying areas required to be moved or it will get wet
- water overtopping roads, but not very deep, (less than 4") or fast flowing
- water on bike paths
- inconvenience or nuisance flooding
- water may accumulate beneath and in homes in historically vulnerable areas containing at-grade slab foundations, crawl spaces or in storage areas below base flood elevation

It is anticipated that minor flooding may be expected to occur from storm events with a 2-10 year recurrence interval.

### **Moderate Flooding** *is defined as:*

Flooding occurs within 6 hours of heavy rain. Storm drains and detention ponds overflow. . In flatter terrain, expanded areas of inundation occur around developed areas, covering secondary roads and sections of neighborhoods, especially in historically vulnerable locations. Moderate flooding impacts result in an increased threat to life and property. Examples of conditions that would be considered moderate flooding include:

- multiple buildings flooded with minor to moderate damage
- multiple homes flooded in historically vulnerable areas containing at-grade slab foundations, crawl spaces or in storage areas below base flood elevation
- various types of infrastructure rendered temporarily incapacitated (i.e. fuel tanks cannot be reached due to high water, roads flooded that have no alternates, access to facilities limited).
- water over the road is deep enough to begin making normal driving conditions hazardous, ( 4"-6" depth)
- water deep enough to make life difficult, normal life is disrupted and hardship is endured
- vehicular travel is restricted or limited in historically vulnerable areas of Town
- moderate degree of danger to residents and property damage

It is anticipated that moderate flooding may be expected to occur from storm events with a 25-50 year recurrence interval.

**Major Flooding** *is defined as:*

Flooding occurs within 6 hours of heavy rain. Storm drains and detention ponds overflow and spillover onto adjoining properties. Tributaries, drainage canals, ditches and swales overflow and overspill their banks in most all low-lying areas. In flatter terrain, extensive inundation occurs covering both primary and secondary roads. Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations. Overall, flooding significantly impacts many buildings and roads with many evacuations necessary; damage is major. Examples of conditions that would be considered major flooding include:

- significant number of buildings flooded, some with substantial damage or destruction
- infrastructure damaged or rendered incapacitated for an extended period of time
- significant number of homes flooded Town-wide with substantial floodwater damage
- water over the road is deep enough to make driving unsafe, ( greater than 6" depth)
- emergency conditions exist with threat to life
- loss of transportation access along primary and secondary roadways, communication, and/or powers are likely
- high damage estimates and high degree of danger to residents

It is anticipated that major flooding may be expected to occur from storm events with a 100 year + recurrence interval.